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ABSTRACT

A study investigated the effects of Interactive Television (ITV--a two-way television system of instruction which is a near replication of face-to-face classroom instruction) on learning. Sixty-seven rural, midwestern high school students who were taking classes via ITV were asked to complete a network analysis survey to identify the frequency of communication interactions students and teachers had with each class member; whether that interaction was personal or social, or work and school related or both; and whether those interactions were face-to-face in class, face-to-face out of class, on the telephone, or across the screen. Students were also administered a field-tested revised student opinion survey, which measured demographics and three dimensions of student attitudes, towards: the class, the technology, and the teacher's use of the technology. A third instrument, the teacher opinion survey, was distributed to the ITV teachers to solicit general information about their teaching experience. Results indicated that remote-site students had consistently less interaction than on-site students, but in total interactions across the screen and total telephone interactions, on-site students generally had a lower mean than remote-site students. Results also indicated that although the teachers appeared to make a concerted effort to mold the multiple sites into one cohesive classroom, they were not completely successful. Results showed that more than three equipment failures per week hindered communication as well. (Seven tables of data are included; 3 appendixes including student opinion surveys and teacher opinion surveys and 30 references are attached.) (PRA)

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ATTITUDE AND COMMUNICATION IN THE ELECTRONIC CLASSROOM:
A CLOSER LOOK AT THE INTERACTIVE TELEVISION SYSTEM
OF INSTRUCTION

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Attitude and Communication in the Electronic Classroom:
A Closer Look at the Interactive Television System of Instruction

Traditionally, education has taken place in a central location where students gather with a teacher to participate in learning. Unfortunately, this method of education has made it prohibitive for rural populations and the growing numbers of nontraditional college students to participate in certain secondary and college level opportunities. Additionally, cost considerations have created a demand for more accessible forms of instruction (Boen, 1985; Neuman, 1990). As a result, interactive television instruction (ITV) has been introduced to fill this growing need.

ITV is a two-way television system of instruction which is a near replication of face-to-face classroom instruction. Students and teachers at different locations have live interaction both visually and orally. Cameras focus on students and the teacher allowing them to see each other on classroom monitors. Microphones at each desk allow immediate interaction. This and other less sophisticated forms of distance education have been used successfully around the country and in other parts of the world (Denton, Clark, Rossing, & O'Connor, 1984; Lewis & Wall, 1988; Lienau, 1987; Lipsky, 1984; Shaw, 1987). Canada, for instance, was able to offer a graduate education to nursing students in various remote locations by audioteleconferencing. This provided students who were unable to travel to campus with an education and the country with a much needed nursing staff (Carver & MacKay, 1986). Electronic education has succeeded in linking many other students hundreds of miles apart with new learning opportunities as well as with each other.

As a means of transmitting information, mediated instruction has been successful. Students learn academics well in electronic classrooms (Robinson & West, 1986; Dirr, 1987; Carver & MacKay, 1986; Hult, 1980). Dirr (1987) reports over 300 studies indicate academic learning is taking place through various types of televised instruction. Institutions have been successful in providing educational opportunities more equitably and filling the academic needs of thousands of secondary and college level students (Lipsky, 1984; Robinson & West, 1986; Lienau, 1987; Lewis & Wall, 1988).

Despite the documented success of ITV as a means of conveying content and developing the

cognitive domain, little attention has been devoted to the affective dimension of learning. Technology has rushed forward in a flurry of activity without promoters pausing to critically evaluate the personal impact on students. Questions such as the following must be asked: How do students feel about ITV? How does it influence the socialization process? What is the impact of being separated from the teacher and the other students? How is the communication network affected by distance and technology?

Although some researchers give the impression that the rapid growth (Meuter, Wright, & Urbanowicz, 1984; Goode, 1990; Lipsky, 1984) and apparent popularity of mediated instruction means that all student needs are adequately met (Lienau, 1987; Robinson & West, 1986), closer scrutiny indicates communication and socialization aspects of the academic experience are being sacrificed (Herold, 1977; Robinson & West, 1986). "A statement by the National Education Association's educational technology committee, for instance, notes the potential of distance education to substitute the age-old teacher-student relationship with a relationship between students and a 'teacher in an electronic box,' which the committee sees as a definite step backward for American education" (Goode, 1990, p. 55).

In the traditional classroom as in the electronic one, the focus has been on cognitive development while overlooking the concern voiced by others about the neglect of the affective experience. Educators have emphasized the traditional three Rs of cognitive learning at the expense of the affective domain (Hunt, 1987). To a certain extent, affect is part of all human experience including learning (Combs, 1982). Learners are more than embodiments of facts and information. They are people who act, react and interact with others. Additionally, education should not only give information but develop individuals who will contribute to humanity. Beane (1985/1986) is particularly critical of the omission of the affective domain in the learning experience. "To ignore one [domain of learning] is to deny what makes us deeply human" (p. 26). As Fisher (1982) suggests, it is time a forth R is added to education: relating, which is the function of all communication.

Given the fact that interaction between students and teachers at different locations is artificially altered in the ITV classroom, it would appear that both the quality and quantity of communication within the ITV class is influenced. Therefore, if the affective experience is critical

to the development of students within the traditional classroom, it becomes even more important when instruction is electronically mediated. Carkhuff (1982) says, "We now stand on the threshold of the Electronics Revolution" in which telecommunications plays a part in the "common mission" of "unimpeded global flow of information. The Electronic Age makes interpersonal skills more vital than ever before" (p. 484).

REVIEW OF THE LITERATURE

Williams (1987) has said, "Although the technological innovations may continue to impress us, it is ultimately the impact upon people that is the real and continuing change that we sense and to which we are challenged to adjust " (p. v). This statement draws attention to the differences between traditional classrooms and electronic ones. Communication is a function which now has an electronic middleman. The distance which separates students from each other and the teacher is unnaturally altered. The interplay of this distance and the technology on the interactions between sites modifies the normal mode of relating. These changes must be assessed to determine what, if any, the impact is on the attitude and communication behaviors between students and teachers at different locations.

The most obvious impact of the technology on students is equipment malfunctions and operator error disrupting communication. Robinson & West (1986) observed technical problems to be the greatest obstacle to learning. The technology can also become an obstacle to communication in more subtle ways. McClelland (1987) reports the interesting phenomena of the "invisible classroom" which he describes as a remote site group which has infrequent or inadequate interactions with the teacher and other sites. This author has observed that in one ITV class, a particular school was not on camera as often as others. Facilitators and students at that school felt it was not treated equitably. The students at that site dropped the course. Such instances underscore McClelland's observation: technology disrupts communication.

Farley (1982) further emphasizes the importance of teacher-student communication. He reports a study of the essential student-teacher interaction such as proximity, touch, feedback, and affirming. These interpersonal behaviors were found to influence attitude and attendance. Unfortunately, they would be difficult or impossible to perform in the ITV classroom.

Types of feedback such as listening and affirming and correcting a student's performance are more constrained in an ITV classroom than in the traditional setting. In the ITV class which has more than two remote sites, one class will always be off the air. Obviously, when this occurs it is impossible for the teacher to provide feedback to a student who is out of view. Also, the student would have less opportunity to get the teacher's attention to ask questions. Furthermore, it has been this author's experience and that reported by ITV teachers that it is difficult to see and hear all students at remote sites. Because of this, it is hard to determine who is asking a question or to see the look of confusion on the face of a remote-site student. The loss of these more subtle nonverbal messages diminishes interpersonal effectiveness.

That television is no substitute for the presence of an in-class teacher is apparent (Neufeld, 1985). Neufeld reports that 24% of the respondents in a pilot study wanted more contact with the instructor than they received in the ITV classroom. Even though twice as many indicated they did not feel this need, one fourth of the classroom expressed this dissatisfaction with the ITV system. The teachers, on the other hand, have voiced concern about the lack of student participation (Seamons, 1987). Hughes (1988) also expressed the need to examine the impact of the medium on student-teacher communication and the intimacy of communication. "The great paradox of the Electronics Age is that it requires the most human of people, sophisticated and skilled in their affective development and communication" (Carkhuff, 1982, p. 485). Yet, the medium limits the message.

Communication in the ITV classroom is further influenced by the perception of distance. Research in the area of proxemics tells us that individuals with too much distance between them during communication are likely to be uncomfortable or dissatisfied with the interaction (Leathers, 1986). Though the television screen in the ITV classroom may be only a few feet away, the students appear much more removed. This distance factor would make communication between sites less likely than communication within the immediate classroom. Students and teachers do prefer classroom environments that "maximize opportunities for uninhibited communicative interaction" (Leathers, 1986, p. 269). This principle would also apply to student-student interaction which was reported as inferior to traditional classrooms (Neufeld, 1985).

Williams (1977) identified a remoteness created by telecommunication which causes human

beings to appear less real, rather semimechanical. One of the consequences of this media-induced change is a disruption of the acquaintance process (Carl, 1986; Williams, 1977). Walker, Hackman, & Eames (1989) commented, "It is an unlikely consequence of telecommunicated instruction...that students feel a 'social bond' with instructors and other distant learners" (pp. 13-14).

Williams (1977) also observed that it is easier to mistreat others in mediated communication. The implications of this depersonalization in the ITV classroom are far ranging. Students not only could be less communicative as indicated by difficulty in the acquaintance process, but when they do communicate, it could be in destructive ways. They may more easily display disrespect for the instructor, disregard for instruction or even open rebellion. Comments made by remote-site students may be laughed at or ignored. Likewise, teachers may unintentionally be less sensitive to individual student needs and respond more passively or aggressively if Williams' theory is correct. This makes the long term impact of mediated interaction on interpersonal skills appear to be a negative one.

Hughes (1988) acknowledges that although two-way ITV instruction is the best replication of live in-class instruction, it still contains a level of remoteness. Because of this, ITV teachers must work toward personalizing such a course. If entire classes can become "invisible," how much more easily could a single, quiet remote-site student disappear without notice? If it is often hard to read students' expressions and difficult to tell who is talking, what kind of atmosphere is being generated?

In the ITV classroom technology, distance, depersonalization, and communication limitations disrupt the socialization and communication processes and the acquisition of interpersonal skills. Since research is limited and the findings about ITV instruction tentative and because it appears to be an essential part of the future in education, further investigation of its impact seems warranted. Based on recent findings, the following hypotheses were formulated:

H 1: Students at remote sites will have less interaction with the teacher and students than students on-site.

H 2: Equipment failure will negatively influence the frequency of communication interaction.

H 3: Students who have more interaction with the teacher and other students will have a more positive attitude toward ITV.

H 4: The more frequently equipment fails the more negative student attitude toward ITV.

METHODS

Respondents

Sixty-seven students who were enrolled in French I, Advanced Placement Calculus and Statistics, and English ITV high school classes in rural midwestern communities were studied. All the classes met five times a week. These courses involved students located at five different high schools. The students ranged in age from fourteen to eighteen. Three of the five ITV teachers also participated.

Context

The high school courses taught on the ITV system of instruction met in identical ITV rooms at their respective high schools. The teachers and students were able to interact live with remote sites and without delayed transmission via television and the use of desktop microphones for the students and a clip-on microphone for the teacher. The system which was used by each class consists of three televisions at each remote site and in the on-site classroom where the teacher was located. Students at one site can see and hear all the students at two other sites and the teacher. Likewise, the teacher can see and hear all the students at two other sites simultaneously. If there are more than two remote sites as was the case in some of the classes studied, then not all the students can be televised at the same time. The teacher must alternate between classes. Besides cameras focusing on the teacher and students, there is also a desktop camera at the teacher's station so that close-ups may be made of detailed work, such as processing a math problem, which would normally be done on a chalkboard. The teacher controls whether the overhead, teacher or class camera is used. Only one person or thing at a time (i.e. teacher, student, or close-up) can be shown on the television which broadcasts on-site activity. The teacher's desk also contains

volume controls for all sites, and videotaping equipment. This arrangement allows a tape to be shown to all sites or for a class session to be recorded for an absent student to view later. The operation of the equipment is simple enough that once trained, the teacher can operate the classroom without a technician present.

Remote-site classrooms also have a teacher desk and are identically equipped as the on-site classroom. Classes can, therefore, be taught from any site. Students at remote-sites can also use the teacher camera to broadcast the details of their work to the teacher at another site or to show something to the entire class. Each class had one teacher in one classroom who broadcast to other remote sites. French and Statistics classes were both broadcast to three remote sites which made it impossible to see and hear all sites simultaneously. In these two classes, the teacher needed to switch from class to class so that all classes had an opportunity to be on screen. English was broadcast to one other site, and Calculus was broadcast to two other sites.

Instruments

Network Analysis Survey

Students were asked to complete the Network Analysis Survey (see Appendix A). A communication network for each class was defined as the on-site and remote-site students, the teacher, and all individuals who were not members of the class that have interactions with students or the teacher during class time. The purpose of the network analysis was to identify the frequency of communication interactions students and teachers had with each class member, whether that interaction was personal and social, work and school related or both, and whether those interactions were face-to-face in class, face-to-face out of class, on the telephone or across the screen.

Students were also administered the field tested Revised Student Opinion Survey (see Appendix B). This survey contained ten questions about demographic information which required a written response. These questions were followed by twenty-five Likert-like statements with response choices from strongly agree to strongly disagree. The instrument measured three dimensions of student attitude: attitude toward the class, the technology and teacher's use of the technology. Following the survey statements, students were requested to make written comments

about the class.

A third instrument was distributed to the ITV teachers. The Teacher Opinion Survey was used to solicit general information about their teaching experience. This questionnaire contained five open-ended questions which provided the ITV teachers with an opportunity to express their feelings about teaching on ITV (see Appendix C). These questions were used to gain additional insight about the functioning of the ITV classroom and to confirm or reject research findings and student perceptions about this learning environment.

Procedures

This study was conducted utilizing an ITV system. Instructions for completing the survey instruments were broadcast live from a midwestern college to the five area high schools where students were located. All the students at each site for each course received instructions simultaneously during their regular class time.

To determine whether or not the hypotheses were supported by the responses to the Network Analysis and the Revised Student Opinion Survey, three tests were conducted: Analysis of Variance statistical test, Tukey's *t*-test, and Pearson's Correlation Coefficient. These tests were used to identify the relationships of the independent variables: 1) site where students were located, i.e. on-site with the teacher or at a remote site, 2) the number of equipment failures each week either complete or partial, and 3) the frequency of communication interactions each week with members of the class communication network, to the dependent variables of attitude toward the class, the technology and the teachers handling of the technology.

Descriptive statistics, comments made by students and teachers on the surveys, and interviews with teachers and facilitators were also used to gather anecdotal information and gain additional insight into the information gathered on the surveys.

By utilizing multiple statistical devices coupled with an examination of the written responses of the students and teachers, the research design allowed for multiple perspectives on the data.

RESULTS

The results of the Analysis of Variance statistical test strongly supported Hypothesis 1. Students at remote sites were found to have less interaction with the teacher and students than students on-site (see Table 1). A comparison of the means using Tukey's *t*-test indicated that the number of people communicated with, the total number of interactions, the number of conversations which were both social and academic, the total number of face-to-face, in-class conversations and the total number of face-to-face, out-of-class conversations were significantly affected by the site where the student was located (see Table 2). Students on-site with the teacher had a higher number of total interactions than any of the remote-site students. On-site students tended to communicate more with students at their same site than with other sites across the screen. Their on-site interaction was also more frequent than the in-class, face-to-face interaction of the remote-site students. The number of people they talked with about both social and academic topics was also significantly higher than at remote sites.

Table 1.
Site and Interaction Values

Variable	df	f	p
NPCON	3,63	2.99	0.0375
TOTINT	3,63	3.79	0.0146
NPBOTH	3,63	7.44	0.0002
TOTFAC	3,63	23.57	0.0001
TOTOUT	3,63	12.34	0.0001

NPCON = number of persons having conversations with; TOTINT = total interactions;
NPBOTH = number of persons having both social and academic conversations with;
TOTFAC = total number of face-to-face in-class conversations; TOTOUT = total number
of face-to-face out-of-class conversations

The Analysis of Variance statistical test was used to determine the effect of equipment failure on communication. A comparison of the means using Tukey's *t*-test supported Hypothesis 2. Results indicated that the average number of times each week the equipment failed and the number of people

communicated with, the total number of conversations a student had with members of his or her class

Table 2.
Means of Site & Interactions

Variable	On-Site Means	Site A Means	Site B Means	Site C Means
NPCOM*	12.02	7.00	10.93	7.55
TOTINT*	125.66	51.85	117.60	71.00
NPPSO	1.00	1.14	1.60	1.77
NPCON	4.13	3.85	4.53	3.55
NPBOTH*	6.80	2.00	5.13	2.44
TOTSCR	2.22	4.71	5.26	2.00
TOTTEL	0.38	0.42	1.20	0.33
TOTFAC*	9.88	2.85	5.80	2.44
TOTOUT*	7.80	1.42	4.33	2.00
RATIO	10.11	8.50	9.91	9.52

NPCOM = number of persons having conversations with; TOTINT = total interactions;
NPPSO = number of persons having only social conversations with; NPCON = number of persons having conversations with about school and class work only; NPBOTH = number of persons having both social and academic conversations with; TOTFAC = total number of face-to-face in-class conversations; TOTOUT = total number of face-to-face out-of-class conversations

*indicates significance

network, and the average number of people communicated with were significantly related (see Table 3). Communication increased up to three failures per week and declined after that. Students had the most interactions at three failures per week which was twice as high as the number of conversations at five failures per week. The average number of persons communicated with was five times higher with one failure per week than it was at five failures per week indicating that equipment failure influenced communication (see Table 4).

Table 3.
Values of Failures and Communication

Variable	df	f	p
NPCOM	5,56	2.61	0.0344
TOTINT	5,56	3.86	0.0045
NPCON	5,56	2.35	0.0525
RATIO	5,56	2.30	0.0572

NPCOM = number of people communicated with
 TOTINT = total number of conversations
 NPCON = number of conversations about course work
 RATIO = average number of conversations

Table 4.
Means of
Communication and Frequency of Failures

Failures	NPCOM	TOTINT	NPCON	RATIO
1 fail/wk	12.0	97	5.00	7.85
2 fail/wk	9.22	74	4.45	8.17
3 fail/wk	12.4	143	4.81	10.8
4 fail/wk	11.2	117	3.07	10.1
5 fail/wk	6.50	79	1.16	11.5

NPCOM = number of people communicated with
 TOTINT = total number of conversations
 NPCON = number of conversations about course work only
 RATIO = average number of conversations

The results of the Pearson Correlation Coefficient partially supported Hypothesis 3. Results indicated that the greater average number of conversations the more positive was the student attitude toward the technology. When the total number of telephone conversations with members of the

communication network increased, attitude toward the teacher's handling of the technology became significantly more positive (see Table 5).

Table 5.
Correlation Values and TOTTEL, RATIO,
and Dimensions

	TOTTEL	RATIO
Technology	$r < 0.31170$ $p < 0.0102$	$r < 0.38076$ $p < 0.0015$
Teacher	$r < 0.31182$ $p < 0.0102$	$r < 0.21337$ $p < 0.0830$

TOTTEL = total telephone conversations
RATIO = average number of conversations

The Analysis of Variance statistical test was used to determine the effect of equipment failure on attitude. The results did not support Hypothesis 4 ($df=5,61$; $f=1.94$; $p=0.10$). Results indicated that the number of times equipment failed either in whole or part each week did not significantly influence the attitude of students toward the class (see Table 6). Attitudes did become noticeably, but not significantly, more negative as the number of failures increased. Students who experienced only one equipment failure per week had a very positive attitude toward the class and a fairly positive attitude toward the technology and the teacher's use of the technology. Attitudes directed specifically toward the technology were the most negative at all levels of failure for all three dimensions. Students who experienced five equipment failures each week had the most negative attitudes in all three areas (see Table 7).

Table 6.
Attitudes and Number of failures

Dimension	df	f	p
Class	5,61	1.94	0.100
Technology	5,61	1.65	0.160
Teacher	5,61	1.25	0.297

Table 7.
Means of
Student Attitude and Frequency of Downtime

Downtime	Class	Technology	Teacher
1 fail/wk	2.00	2.41	2.41
2 fail/wk	2.76	2.97	2.50
3 fail/wk	3.06	3.53	2.68
4 fail/wk	2.94	3.29	2.74
5 fail/wk	3.04	3.58	3.04

Additional Findings

The descriptive statistics produced a noteworthy result which is consistent with previous research. On the Revised Student Opinion Survey, students strongly agreed they would prefer being in the classroom with the teacher ($M=1.7$). This supports the same findings of Neufeld (1985) and Herold (1977). This preference expressed by students is also consistent with Williams (1977) comments about depersonalization and the concerns of other researchers about remoteness (Walker et al, 1989) and the acquaintance process (Carl, 1989). This feeling was reemphasized in student comments about either being glad they were with the teacher, wishing they were, or not wanting to

take another ITV class unless they were at the site with the teacher. The teachers' responses to the Teacher Opinion Survey underscored the concern about remote-site students and the inability to create the kind of intimacy and relationships with those students that they would like to have.

Discussion

Results of this research indicated a number of important factors related to communication within the ITV classroom. It was not surprising to find that remote-site students are at a definite disadvantage in terms of communication. Results revealed that they had consistently less interaction than on-site students. Four of the nine communication areas studied when compared to site produced significant scores. Students at the site with the teacher had higher means in all aspects of communication interactions except three (see Table 2). The usually larger on-site classes may account for the larger number of interactions. Remote site students in this study had consistently fewer students than on-site locations, some as few as one or two. This disparity is probably a fairly widespread occurrence in distance education. Smaller numbers result in less opportunities for developing a communication network placing remote sites at a continual disadvantage. This size differential may also account for a higher total number of people interacted with on-site, but the ratio which accounts for varying class size was also higher than any of the remote sites. So, size alone does not explain lack of interaction.

In total interactions across the screen and total telephone interactions, on-site students had a lower mean than remote site students except for students at school C. Students at sites A & B both had a means over twice as high for on-screen conversations as on-site and school C. Students on-site perhaps made fewer comments across the screen because they could talk with the teacher face-to-face to complete assignments. They may not have cared to begin friendships with other schools. Also, on-site students tend to blame remote sites for problems in the class creating a further handicap to remote-site students becoming integrated into the communication network and another reason for on-site students not to talk to them. School C was blamed most often and appears to be the "out" school as discussed by McClelland (1987). This school may be less assertive across the screen simply because its students are more reserved, or they may sense rejection from the other schools and tend to be quiet for that reason. Either way, the reserve of this site is probably contributing to its

"invisibility."

The teachers in this study appeared to make a concerted effort to mold the multiple sites into one cohesive classroom and, yet, were not completely successful. Apparently, success requires much more but just what can be done, and how an equitable experience can be produced for remote-site students remains in question. Perhaps it is more than a teacher can do alone.

The plight of the remote-site student could be remedied in a number of ways. The most immediate need is interaction with the teacher. Remote site students reported not being able to hear the teacher. This might cause them to become discouraged using the system. Adjustments need to be made in the technology so that all students are able to hear the teacher.

A more efficient method of gaining the teacher's attention by remote-site students also is needed. A bell or flashing light at the teachers station to alert the teacher that a student at another location is in need of assistance may be helpful. It might also help in integrating remote sites into class conversations by drawing other student's attention to them.

Another practice which was previously successful is having a resource person at each site. A student who has taken ITV courses could act as a teaching assistant and advocate at each remote site. This person could be both moral support and act as a liaison with the teacher, identifying problems students may be reluctant to bring to the teacher's attention such as shyness or a need for clarification on a particular lesson. A support structure among students at each site such as a discussion group or study partners and continuing to bring students together as a group (as these teachers did) for once a month meetings or parties would further assist in the communication process.

Additionally, students must be required to interact and take responsibility for their own communication behavior. Perhaps receiving a grade for class participation would make speaking up of greater value to them. Encouraging across site discussion by pairing students at different sites for problem solving would provide an opportunity to integrate all students into the communication network.

While examining the variables of equipment failure and communication, a number of unanticipated significant relationships occurred. Although equipment failure limits the number of people within a network, students communicated with greater numbers of students when the equipment failed up to four times a week than when it was functioning. At five failures a week, the

number of people communicated with dropped drastically. This indicates that while students were unable to talk across the screen, they must have been communicating with more students at their site and/or those at sites where the technology was not interfering with the broadcast.

The total number of interactions was also significantly related to equipment failures. Initially, it would seem that if sections of the class were cut off from each other, for instance, if site C was unable to see or hear site B, conversations would be limited. Instead, they increased up to three failures a week and still remained high at four failures per week before dropping at five failures per week. Possibly students were turning to others at their sites and attempting to work through problems and assignments and/or socializing if they were separated from the teacher. Those on-site might have talked more with the teacher and each other because they were not contending with other sites. On-site students suddenly become a single, traditional class.

One might speculate that with up to three failures each week students were making an effort to remain connected to the class and the lessons. This is supported by the concern students expressed about their grades being influenced by equipment failures. Research indicates that this fear is not unfounded. As reported by Ellis & Mathis (1985), equipment failure does result in lower test scores. Students also expressed concern about their ability to perform on the college examinations that these classes were supposed to be preparing them to take. Also, the number of conversations about course work was higher than average until four failures per week.

After three failures per week, communication began to diminish. Possibly students became so discouraged that they gave up their efforts to remain an active part of the communication network. When equipment fails during every fifty minute class session, it is easy to understand discouragement. Additionally, the opportunity to make contact with students is greatly diminished. When the system was "down" for two weeks at a time (as was the case), communication would be impossible except by telephone. During one such period, one teacher traveled to a remote site which had only one student. This teacher reported the student to be very discouraged but feeling much better after the individual instruction. For this student, the teacher traveling and telephone contact were the only means of remaining connected with the class.

The breakdown in communication that occurs with a high number of equipment failures each week takes away from the type of affective experience that students have. Though they probably

remain in contact with the teacher, the interaction among students is significantly impaired as would be expected. The quality of the affective experience must be brought into question under these circumstances. Certainly, for students who are serious about their education the learning experience is being frustrated.

The investigation of Hypothesis 3 also reflected a relationship between communication and attitude: the more conversations the more positive the attitude toward the technology. Because the students develop friendships within their ITV class or are able to talk with the teacher, the technology appears friendlier too. It would be fascinating to know what kinds of conversations made the difference, especially since an increase in total number of telephone conversations also caused a more positive attitude toward the technology and the teacher's use of the technology. What did students discuss on the telephone that improved their attitude toward the teacher?

Perhaps the most striking result of this study came from the analysis of Hypothesis 4. Though 96% of the students experienced equipment failure at least once a week, this was not significantly related to any of the aspects of attitude measured. In the sample for this study, fifty-five of the sixty-seven students surveyed had grade point averages over 3.00, and the courses they were enrolled in were advanced. The network analysis also indicated that conversation content was more academic than social. This information shows that most of the students had a serious attitude toward their studies. Fifty-five of the students were at least seventeen years old and sixty-four were juniors and seniors which further indicates that the sample studied was a mature and motivated group of students. Though twenty-three students complained about equipment failure in their comments, their attitude toward the class was not significantly influenced by these failures. Apparently, these types of learners can better cope with the frustrations and interruptions caused by equipment failures.

It should also be noted that although there was not a significant relationship between attitude and failures, there was the tendency to be more negative with five failures than with one. A negative attitude toward a system that fails that frequently is a reasonable response. When a system which is needed in order to learn is malfunctioning, students would naturally become discouraged. However, in new systems like the one under study frequent equipment failures are common.

Conclusion

The purpose of this study was to investigate the attitudes and communication behaviors of students in ITV classrooms. Results indicated a number of significant relationships and others which approach significance. These findings were consistent with those found by previous researchers. Others have not been explored in the literature as yet. Certainly, ITV instruction is the trend in education and should be further investigated so that it can be used effectively in the future.

APPENDIX A

Network Analysis

This page includes a complete list of the students and teacher in this ITV course. Read the list and use the appropriate symbol next to each name to indicate the frequency and content of your conversations and type of contact. A "contact" is exchanging information beyond, "Hi! How are you." If you have no contact with an individual, please leave the spaces next to the name blank. In the extra spaces, name anyone else who enters the ITV room during class and use appropriate symbols after their name. Circle your name and leave the line next to it blank

- Frequency of conversation
 1. 1-5 times/week
 2. 5-10 times/week
 3. 10-15 times/week
 4. 16 or more times/week

- Content of conversation
 A. personal and social
 B. about class work or school

- Type of contact
 a. on screen
 b. telephone
 c. face-to-face in class
 d. face-to-face outside class

	FREQUENCY	CONTENT	TYPE
1. John Doe	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____
11.	_____	_____	_____
12.	_____	_____	_____
13.	_____	_____	_____
14.	_____	_____	_____
15.	_____	_____	_____
16.	_____	_____	_____
17.	_____	_____	_____
18.	_____	_____	_____
19.	_____	_____	_____
20.	_____	_____	_____
21.	_____	_____	_____
22.	_____	_____	_____

APPENDIX B

Revised Student Opinion Survey

The purpose of this survey is to assist teachers in improving the televised system of instruction so that students will have a positive learning experience. Your answers are confidential and will not influence your grade.

- 1.) Age: ____ 2.) Sex: ____ 3.) GPA: ____ 4.) Class subject: ____
5.) Date you began this course: ____
6.) Grade: Freshman ____ Sophomore ____ Junior ____ Senior ____
7.) Grade you expect to receive in this class: ____
8.) Are you at the site with the teacher? yes ____ no ____
9.) Have you taken an ITV course before? yes ____ no ____
10.) Please estimate the average number of times each week the equipment failed (for instance, it didn't broadcast or there was no sound or picture).
Circle one: 0 1 2 3 4 5

.....

Directions: Answer each question below by placing a check mark over the response which best reflects your opinion. For instance: President Bush is an honest man. If you believe the President is very honest, mark "Strongly agree." If you believe he is generally, but not very, honest, mark "Agree." If you have no opinion, mark "Undecided." If he is a little dishonest, in your opinion, mark "Disagree." If he is quite dishonest, mark "Strongly Disagree."

1. I look forward to attending this class.

strongly agree agree undecided disagree strongly disagree

2. I am uncomfortable knowing I am on TV.

strongly agree agree undecided disagree strongly disagree

3. Learning is easy from the ITV system.

strongly agree agree undecided disagree strongly disagree

4. I had a negative opinion of ITV classes before actually taking one.

strongly agree agree undecided disagree strongly disagree

5. Equipment failure did not interfere with my learning.
strongly agree agree undecided disagree strongly disagree
6. It bothers me to use a microphone.
strongly agree agree undecided disagree strongly disagree
7. I enjoy being able to talk with students at other schools.
strongly agree agree undecided disagree strongly disagree
8. I do not like learning in an ITV classroom.
strongly agree agree undecided disagree strongly disagree
9. The information presented in this class has been easy to follow .
strongly agree agree undecided disagree strongly disagree
10. I would like to see students at other sites more often on the screen.
strongly agree agree undecided disagree strongly disagree
11. I was not able to ask questions of the teacher as often as I liked.
strongly agree agree undecided disagree strongly disagree
12. The camera did not always show me what I wanted to see.
strongly agree agree undecided disagree strongly disagree
13. I could hear the students at other sites well.
strongly agree agree undecided disagree strongly disagree
14. I could see the students in other classrooms well.
strongly agree agree undecided disagree strongly disagree
15. Visual aids were not easy to see and follow.
strongly agree agree undecided disagree strongly disagree

If you are in the classroom with the teacher, please skip to question #23.

If the teacher was not present in your classroom, please continue.

16. Sometimes I have difficulty concentrating on the television presentation.

strongly agree agree undecided disagree strongly disagree

17. Handouts were not received in time for the assignments.

strongly agree agree undecided disagree strongly disagree

18. I saw the teacher on the screen as often as I would like.

strongly agree agree undecided disagree strongly disagree

19. I would prefer being in the classroom with the teacher.

strongly agree agree undecided disagree strongly disagree

20. I could not hear the teacher well.

strongly agree agree undecided disagree strongly disagree

21. I could see the teacher's gestures and facial expressions well.

strongly agree agree undecided disagree strongly disagree

22. The teacher's style of presentation seems natural on the screen.

strongly agree agree undecided disagree strongly disagree

23. If I had the chance, I would take another ITV class.

strongly agree agree undecided disagree strongly disagree

Are there additional comments you would like to make?

5. Equipment failure did not interfere with my learning.

strongly agree agree undecided disagree strongly disagree

6. It bothers me to use a microphone.

strongly agree agree undecided disagree strongly disagree

7. I enjoy being able to talk with students at other schools.

strongly agree agree undecided disagree strongly disagree

8. I do not like learning in an ITV classroom.

strongly agree agree undecided disagree strongly disagree

9. The information presented in this class has been easy to follow.

strongly agree agree undecided disagree strongly disagree

10. I would like to see students at other sites more often on the screen.

strongly agree agree undecided disagree strongly disagree

11. I was not able to ask questions of the teacher as often as I liked.

strongly agree agree undecided disagree strongly disagree

12. The camera did not always show me what I wanted to see.

strongly agree agree undecided disagree strongly disagree

13. I could hear the students at other sites well.

strongly agree agree undecided disagree strongly disagree

14. I could see the students in other classrooms well.

strongly agree agree undecided disagree strongly disagree

15. Visual aids were not easy to see and follow.

strongly agree agree undecided disagree strongly disagree

If you are in the classroom with the teacher, please skip to question #23.

If the teacher was not present in your classroom, please continue.

Appendix C
Teacher Opinion Survey

In order to gain your perspective on the ITV system, I would appreciate your comments on the following questions.

1. What do you see as the biggest change in instructional style or methods when using ITV?

2. What do you find most difficult about teaching on ITV?

3. What do you find about the ITV teaching that is better than teaching in a regular classroom?

4. Please describe any special contact you have had with remote-site students (such as phone calls, visits to their schools etc.)

5. Do you think the ITV system is a good instructional medium?

Please make additional comments on the back.

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